FALL MEETING OF THE AMERICAN GEOPHYSICAL UNION:

The Earthquake That Will Eat Tokyo

Denizens of the megalopolis of Tokyo are finally emerging from the threat of their own Big One. The megaquake that last struck offshore in 1923, killing 105,000 people, is not likely to return for many, many decades, researchers in a joint U.S.-Japan study reported at the meeting. But the same study finds that a far more immediate threat—including possible losses totaling $1 trillion—lies right beneath Tokyo and surrounding cities.

One-quarter of Japan's 127 million people live in and around Tokyo on the Kanto Plain. Unfortunately for them, not one but two tectonic plates converge on Japan from the east and dive beneath the edge of the Eurasian Plate and Tokyo. Sliding plates sticking and then snapping free produced quakes of about magnitude 8 in 1923 as well as in 1703.

How frequently do such quakes strike offshore Japan? A 20-member group asked that question at the meeting. The group was headed by seismologists Ross Stein of the U.S. Geological Survey in Menlo Park, California, and Shinji Toda of the Active Fault Research Center in Tsukuba, Japan, and funded in large part by the insurance giant Swiss Re. Each of those great earthquakes lifted the shoreline by a meter or more. That rise created wave-cut terraces perched above present-day beaches, preserving 7000 years of quake history in the terraces. By dating them, "Team Tokyo" researchers found that the last 17 quakes struck about every 400 years on average with surprising regularity. The probability of the next great quake striking in the next 30 years is then just 0.5%, the group reported.

Tokyo didn't get off so easy when Team Tokyo tackled the frequency of smaller quakes beneath the Kanto Plain. To judge by the frequency of earthquakes striking right beneath greater Tokyo, large quakes like the magnitude 7.3 shock of 1855 have about a 20% chance of occurring in an average 30-year period. Combining the two results, the chances of severe shaking in and around Tokyo are about 30% for the next 30 years, the group found, due almost entirely to the threat from beneath the city.

Using seismic records of 300,000 earthquakes in the area, the group believes it has pinned down the source of most of Tokyo's moderate but close-in quakes: a 25-kilometer-thick chunk of the Pacific Plate broken off and stuck between the three plates beneath Tokyo. Until that jam clears in the geologic future, residents of greater Tokyo will live under the threat of a trillion-dollar catastrophe rising from beneath their feet. At the meeting, seismologist David Jackson of the University of California, Los Angeles, raised the possibility that the threat is even larger than that. The great offshore quakes may not be as periodic as Team Tokyo would have them, he warned. The next one might misbehave and come sooner than expected.

–RICHARD A. KERR

Science **315**, 37b (2007); doi: 10.1126/science.315.5808.37b

Team Tokyo website http://sicarius.wr.usgs.gov/tokyo/